filter 22, a mixer 23, a lowpass filter LPF 24 and an analog-to-digital A/D converter 25. The mixer 23 receives an input from a frequency synthesiser 26. As described in relation to the example above, the filter 22 is isolated by turning the LNA 21 off and is then turned into an oscillator by using a compensation circuit (not shown). The oscillator 22 is then locked to the receiver's reference frequency, provided by the frequency synthesiser 26, using a phase locked loop which comprises the oscillator 22, a phase detector 27 and a low pass filter 28. As described above in relation to the first example, once the oscillator has been tuned to the reference frequency, the control signal is sampled and held and the compensation circuit is deactivated, turning the oscillator 22 back into a correctly tuned bandpass filter. The input signal is then restored and the filtered signal multiplied with the reference frequency, low pass filtered and converted to a digital signal in the analog-to-digital converter 25 for further processing by the baseband circuitry BB of the direct conversion receiver. The phase locked loop can be implemented in the analog or digital domain. Where the tuning element is implemented as a switched capacitor bank, the frequency drift is very low, so that frequency tuning can be performed once only, as a calibration step, and the resulting control value stored in a look-up table.

Referring to Figure 12, an RF receiver chain comprises an LNA 31, a bandpass filter 32, a mixer 33, a lowpass filter LPF 34 and an analog-to-digital converter A/D 35. The mixer receives an input from a frequency synthesiser 37. The output of the A/D converter 35 is input to a digital signal processor DSP 36, which controls the LNA 31, filter 32, LPF 34 and frequency synthesiser 37. The tuning algorithm is implemented in software. The bandpass filter 32 is again turned into an oscillator and the oscillator frequency is swept over its entire range. The setting that yields a signal at the output is stored in a look-up table. This process can be repeated until the entire frequency range of the bandpass filter is recorded.

While normal filter operation cannot be carried out while the filter is being tuned, in the majority of cases this is not a problem. In particular, the filter can be calibrated as a one-off procedure the first time it is turned on. For example, referring to Figure 13, a programmable filter according to the invention has a memory 40 for

pre-storing a digital word 41a – n for each of the desired frequencies, so that when it is switched on, the word corresponding to the desired frequency is applied to a digital to analog converter 42 that provides a tuning signal to the filter 43. This leads to a fast programmable filter.

Furthermore, in most high performance communication systems, some kind of time-division multiplexing and/or frequency hopping is employed, so that continuous filter operation is not required. Such systems would allow a filter to be tuned, for example, every millisecond. Most systems also use error correction and are therefore robust to very short periods of time without signal, during which time the filter can be fine tuned.

Claims

1. A method of tuning a filter, the filter being associated with a center frequency, comprising the steps of:

configuring said filter as an oscillator;

tuning said oscillator to a desired frequency; and

reconfiguring said oscillator to operate as said filter with said desired frequency as said center frequency.

2. A method of tuning a filter according to claim 1, wherein said step of configuring said filter as an oscillator comprises compensating for losses in the filter.

3. A method of tuning a filter according to claim 1, wherein the filter comprises a bandpass filter.

4. A method of tuning a filter according to claim 1, wherein the filter comprises a notch filter.

5. A method of tuning a filter according to claim 1, wherein the step of tuning said oscillator comprises providing a tuning signal.

6. A method according to claim 5, further comprising the step of recording the tuning signal which causes said oscillator to operate at the desired frequency.

7. A method according to claim 6, wherein the step of recording the tuning signal comprises sampling and holding the tuning signal.

8. A method according to claim 7, further comprising storing the sampled signal in a register.